



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

Address: COMMISSIONER FOR PATENTS

P.O. Box 1450

Alexandria, Virginia 22313-1450

www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/521,311	01/14/2005	Heiji Watanabe	Q85660	1690
23373 7590 04/15/2009				
SUGHRUE MION, PLLC				
2100 PENNSYLVANIA AVENUE, N.W.				
SUITE 800				
WASHINGTON, DC 20037				
EXAMINER				
WARREN, MATTHEW E				
ART UNIT		PAPER NUMBER		
2815				
MAIL DATE		DELIVERY MODE		
04/15/2009		PAPER		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/521,311

Applicant(s)

WATANABE ET AL.

Examiner

MATTHEW E. WARREN

Art Unit

2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 January 2009.
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 2 and 4-68 is/are pending in the application.
4a) Of the above claim(s) 38-68 is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1, 2, 4-8 and 10-37 is/are rejected.
7) ☒ Claim(s) 9 is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB-08)
Paper No(s)/Mail Date _____
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____

DETAILED ACTION

This Office Action is in response to the RCE and Amendment filed on August 1, 2008.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 2, 10- 26, and 31-37 are rejected under 35 U.S.C. 102(e) as being anticipated by Paton et al. (US 6,703,277 B1).

In re claims 1 and 4-8, Paton et al. shows (fig. 4B) a semiconductor device comprising an insulating film structure which electrically insulates a conductive region (110) from a silicon region (102), wherein said insulating film structure extends on said silicon region and under said conductive region, said insulating film structure further comprising at least one silicate region composed of a silicon oxide containing at least one metal element (col. 10, lines 1-23 and col. 11, lines 5-21), wherein said insulating film structure comprises at least one silicon oxide region (118) composed of a silicon oxide not containing said at least one metal element, at least one metal rich region (120) having high concentration of said at least one metal element, and said at least

one silicate region (108) which is located between said silicon oxide region and said metal rich region and has lower concentration of said at least one metal element than that of said metal rich region (col. 11, lines 5-21). In re the remaining limitations of claims 4-8, because Paton discloses the insulating film structure having the same configuration as the instant invention, the insulating film structure of Paton also has the various configurations of the claims.

In re claim 2, the limitations are "product by process" limitations. In re the remaining limitation of the claim, concerning the one metal element being thermally diffused, the limitation is a "product by process" limitation. A "product by process" claim limitation is directed to the product per se, no matter how actually made, In re Hirao, **190 USPQ 15 at 17**(footnote 3). See also in re Brown, **173 USPQ 685**; In re Luck, **177 USPQ 523**; In re Fessmann, **180 USPQ 324**; In re Avery, **186 USPQ 116** in re Wertheim, **191 USPQ 90** (**209 USPQ 254** does not deal with this issue); and In re Marosi et al, **218 USPQ 289** final product per se which must be determined in a "product by, all of" claim, and not the patentability of the process, and that an old or obvious product, whether claimed in "product by process" claims or not. Note that Applicant has the burden of proof in such cases, as the above case law makes clear. "Even though product-by- process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is

unpatentable even though the prior product is made by a different process.” In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

In re claim 10, Paton shows (fig. 4B) that the silicon region comprises a silicon substrate (102), the conductive region comprises a gate electrode (110), and said insulating film is a gate insulating film.

In re claims 11, 16, and 17, Paton discloses (col. 10, lines 1-23) that the metal element is selected from the group listed in the claim.

In re claims 12-15, and 18-21 the limitations are “product by process” limitations. See the explanation above concerning a “product by process” claim limitation.

In re claims 22-24, as stated above, Paton discloses embodiments (such as fig. 4B) wherein the insulating film comprises first and second silicates. The limitations of the metal element being thermally diffused are “product by process” limitations. See the explanation above concerning a “product by process” claim limitation. The silicon containing insulator is a standard-k material and may contain the materials listed in the claims (col. 10, lines 1-23).

In re claim 31, the limitations are “product by process” limitations. See the explanation above concerning a “product by process” claim limitation.

In re claim 34, Paton shows (fig. 4B) that the silicon region comprises a silicon substrate (102), the conductive region comprises a gate electrode (110), and said insulating film is a gate insulating film. Paton does not specifically disclose the characteristics of the insulator. The insulator of Paton would inherently have the same

properties as the instant invention since the materials and structure are the same as the instant invention.

In re claims 35-37, Paton shows (fig. 4B) said insulating film structure comprises said silicate region composed of a silicon oxide containing said at least one metal element, and a silicon oxide region composed of a silicon oxide not containing a metal element. The physical film thickness of said insulating film structure 3.5 nm or less since Paton discloses that the film layer may have a thickness of 30 Angstroms (equal to 3.0 nm). The physical thickness of said silicate region is thinner than the physical thickness of said silicon oxide region since the individual layers may each have any thickness as desired (col. 9, lines 61-67). Paton also discloses (col. 16, lines 1-15) that the silicate region may have the thickness less than 1.5nm described in the claims.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 25-29 and 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paton et al. (US 6,703,277 B1) as applied to claim 1 above, and further in view of Jeon et al. (US 6,586,349).

In re claims 25, 26, and 32-33, Paton shows all of the elements of the claims except the cap region and its desired parameters. Jeon discloses (col. 10, lines 20-37)

that cap region is a standard-k material and may contain the materials listed in the claims. Jeon also discloses (col. 16, lines 1-15) that the cap layer may have the thickness described in the claims since the thickness of any sublayer may be 5 Angstroms (equal to 0.5 nm). With this configuration the gate insulation structure additional gate insulation. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the gate insulating structure of Paton by forming a cap layer as taught by Jeon to provide additional gate protection.

In re claims 27-29, the references show all of the elements of the claim except the specified parameters of the claims. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the device parameters such as the concentration distribution and composition modulation having the desired values , since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over et al. (US 6,703,277 B1) in view of Jeon et al. (US 6,586,349) as applied to claim 1 above, and further in view of Green et al. (US Pub. 2003/0219972 A).

In re claim 30, Paton and Jeon show all of the elements of the claims except the silicon oxide constituting the at least one silicate region being an oxynitride, which Green et al. discloses [0006] as a well known material in the art. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made

to modify the silicate of Paton and Jeon by using a oxynitride as taught by Green to provide a well known, alternative insulating material.

Allowable Subject Matter

Claim 9 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

Applicant's arguments with respect to claims 1-37 have been considered but are not persuasive. The applicant primarily asserts that the cited prior art references do not show all of the elements of the claims, specifically that Paton et al. does not disclose the silicate region between the metal layer and a silicon oxide region having a lower concentration of metal element. The examiner believes that Paton shows all of the elements of the claims. As stated in the rejection above, Paton discloses in the recited passages (particularly col. 11, lines 5-21) that an upper metal layer (120) reacts with the lower silicon dioxide to form a silicate between them. In a specific example, the upper metal (120) is Hf and reacts with silicon dioxide to form hafnium silicate. Of course it should be understood that the resultant hafnium silicate layer will have less metal than the pure hafnium layer formed above it. The applicant further argues that further thermal processing eliminates the oxide layer (118), however, the recited passages indicate that the further thermal process is another embodiment or an optional process. In another

embodiment (col. 10, lines 50-59), the oxide layer (118) although undesirable, is included to have a specific thickness and be part of the invention (shown in fig. 4B). Therefore, the cited prior art reference shows all of the elements of the claims and this action is made final.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **MATTHEW E. WARREN** whose telephone number is (571)272-1737. The examiner can normally be reached on Mon-Thur and alternating Fri 9:00-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be reached on (571) 272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Matthew E Warren/
Primary Examiner, Art Unit 2815

April 13, 2009